DOCUMENT RESUME

ED 336 498 CE 058 618

TITLE Strategies for Learners with Special Needs in Automobile Mechanics.
INSTITUTION Missouri Univ., Columbia. Missouri LINC.
PUB DATE 91
NOTE 12p.; For other titles in this series, see CE 058 617-623.
AVAILABLE FROM Missouri LINC, 401 East Stewart Road, Columbia, MO 65211.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Auto Mechanics; Cognitive Mapping; *Competency Based Education; *Educational Strategies; Individualized Instruction; Instructional Materials; *Learning Strategies; Modeling (Psychology); Pacing; Secondary Education; Self Evaluation (Individuals); Small Engine Mechanics; *Special Needs Students; Study Guides; Thinking Skills

ABSTRACT

This Vocational Instructional Management System (VIMS) module illustrates instructional and cognitive strategies that can be used to teach and learn vocational competencies in automobile mechanics. Seven definitions, seven frequently asked questions, and nine references are included. The following questions are answered: Is it important to teach strategies? What is an example of an instructional strategy that could be used for an ignition system competency? What learning strategy can be used for this competency? How can mapping be used as a instructional and cognitive strategy? How can an advance organizer teach the VIMS competencies on engine repair? How can students use self-monitoring for this competency? and Where can I get more automobile mechanics materials? (Four sources are listed.) (NLA)

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Overview

Auto mechanics is an occupation requiring prerequisites and proficiencies in many areas. Preparing a student for an auto mechanics career is a challenge due to the diversity in this occupation. Using strategies in the auto mechanics classroom can help meet this challenge.

Strategies necessary to teach vocational competencies should be effectively designed with the intent of preparing a student to work as independently as possible. Utilizing a variety of strategies to help meet the needs of a learner provides the opportunity for independent learning and is an important aspect in the teaching/learning process in all classrooms.

The purpose of this module is to give the instructor methods to teach and the student methods to acquire knowledge in the field of automotive mechanics. When one strategy is ineffective, an alternate one may prove useful.

In this module, several strategies for teaching and learning will be examined. Numerous strategies must be taught and used in classrooms today. For further information and strategy options refer to LINC modules on other vocational areas (i.e. Agriculture, Building Trades, etc.).

Definitions

Advance Organizers

An advance organizer contains information which is presented prior to learning. It helps the learner organize and interpret new information. Advance organizers should be most helpful when students lack the prerequisite knowledge for learning the material. The teacher presents the material to be acquired in an integrated manner with the goal of instruction being the transfer of learning to new information.

Learning/ Cognitive Strategies

These are techniques the student uses to acquire knowledge. Students must be taught **how** to effectively acquire knowledge. Frequently students with special needs have acquired few if any real techniques for learning. Any techniques which have been acquired may be effective some of the time, but often are not effective and result in failure for the student in acquiring new information. These cognitive strategies enable students to confront new information and/or situations with a strategic plan for more successful learning.

Mapping	This strategy provides a specialized outline. Mapping allows more freedom than a structured outline. It also assists students who need to visualize the method of introducing a unit, explaining a concept, preparing for a test and organizing notes. Students with visual perceptual deficits may experience difficulty with the concept and may need a more structured format (Kearns, 1989).
Modeling	Modeling is a strategy in which a behavior is presented in the way it is to be performed. Modeling paired with the verbalization of each instructional step, helps the student think, question and evaluate the learning procedure.
Self-monitoring	This refers to the student learning to monitor individual performance on information being taught. The student studies his or her own memory performance and forms insights into efficient strategies. Monitoring helps make the student a more independent learner (Mercer, 1987, p. 225).
Self-questioning	A self-questioning strategy allows the student to turn a main idea or topic into questions and provides opportunities for practice and feedback (Billingsley & Wildman, 1990).
Teaching/ Instructional Strategy	Techniques utilized by the teacher that enable students to learn are instructional strategies. Instructional strategies include those activities the teacher plans in order to help students of all learning abilities acquire the information being presented.

Frequently Asked Questions

Q. Is it Important to Teach Strategies?

A. Many educators feel the answer to this question is "yes." Current teaching methods too often cover only material rather than showing students how to learn "smarter" and why material being taught is important. When looking at the following dropout rate for special education students in Missouri, an obvious problem exists.

Emotionally Disturbed/Behavior Disordered	62%
Learning Disabled	36%
Educably Mentally Handicapped	30-32%
Speech/Language Impaired	24%
Average Dropout Rate in Missouri	24%

(John Heskett, personal communication, June 13, 1990)

"Training in learning strategies should include an effort to change student's beliefs about the causes of failure. Students should be encouraged to believe that failure is produced by inappropriate learning strategies, and that the ability to generate appropriate strategies can be acquired and improved with practice" (Derry, 1990, p. 28).

One way a teacher can assist students is to provide the skills necessary to complete assignments. The challenge to teachers is to transform passive learners into learners who are more actively involved by teaching them effective strategies for gaining and responding to information (Deshler & Schumaker, 1986). Not providing students with a variety of strategies, is like expecting them to work on an automobile without *Snap-on-Tools*.

Q. What is an Example of an Instructional Strategy That Could be Used for an Ignition System Competency?

A. The VIMS competency of *conducting an engine performance test using an engine analyzer and then determining needed repairs* (IML, 1988a) may be better taught using strategies. Fifteen Automotive Service Excellence (ASE) tasks are included within this competency. Looking at the task H002 (IML Competency profile, Inspect engine assembly for fuel, oil, coolant and other leaks; determine repairs) (IML, 1988b), the instructor might use *modeling* as the strategy. Modeling is a method in which the teacher presents a behavior in the way it is to be performed. This could include a combination of the following to determine needed repairs:

1. Show the student where in the engine assembly to check for fuel, oil, coolant and other leaks. This requires not only showing a student where leaks occur but also verbalizing the process and why this information is important. Then have the student model checking for leaks, using the same steps, including verbalizing, as presented by the teacher.

2. Have available various fluids added to an automobile, then compare color, density and smell. Discuss each quality with the group, then provide each student an opportunity to model the procedure.

3. Show a video tape of possible leaks, reasons leaks occur, and problems that could exist. Have a short discussion of the film, then play games like "Name That Leak," or show fluid samples and "Guess the Fluid." Develop a variety of questions and answers to play "Automobile Jeopardy."

Modeling should be paired with verbalizing each step of instruction, which will eventually allow modeling to be faded. Teachers need to think "out loud" while modeling. Modeling helps the student think, question and evaluate (Billingsley & Wildman, 1990).

Q. What is an Example of a Learning Strategy the Student Might use for This Competency?

A. An example of a cognitive strategy might be a *self-questioning* technique. A self-questioning strategy allows the student to turn a main idea or topic into questions and provide opportunities for practice and feedback (Billingsley & Wildman, 1990). For example, when a student is checking for fluid leaks, a self-questioning technique could be used. This strategy can be taught when the teacher models a competency. Teachers model asking questions out loud to let the student become familiar and understand how to develop questions. In self-questioning, the student asks the questions.

Using fluid leaks as the topic, the student would begin forming questions. For example:

1. What color is the fluid I have found?
2. What does it smell like?
3. Where on the engine assembly was it found?
4. When do leaks occur?
5. What does this fluid leak tell me?

Self-questioning frequently includes "Wh" questions. From these questions the student begins to hypothesize, then forms conclusions. These conclusions can be checked by the student and instructor as they are verbalized. This gives the student immediate feedback.

Mechanics in the field currently use a self-questioning technique to eliminate what is not wrong. "This narrows down the possibilities of a potential problem" (M. L. Leap, personal communication, November 7, 1990).

Q. What is an Example of Mapping That can be Used as a Instructional Strategy and a Cognitive Strategy?

A. Access Skills and the VIMS Competencies require the diagnosis of brake repairs. The instructor may use mapping to illustrate how to trouble shoot possible brake problems. "Mapping is a specialized outline. Use of this strategy provides more freedom than a structured outline. It also assists students who need to visualize the method of introducing a unit, explaining a concept, preparing for a test and organizing notes. Students with visual perceptual deficits may experience difficulty with the concept and may need a more structured format" (Kearns, 1989). The following page is an example using mapping to trouble shoot brake repairs.

Using mapping as a strategy could be an effective method of introducing a lesson. It gives the student a visual representation of the possible problems and solutions to trouble shooting brakes. Once this strategy has been effectively used by the instructor, students can begin to perform mapping strategies independently. Mapping can then be applied to other competencies that may involve an extensive number of tasks.

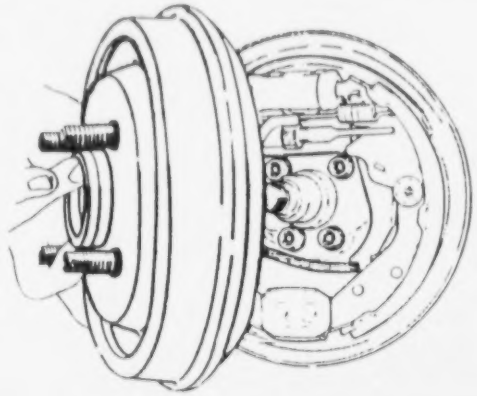
Q. How can an Advance Organizer Help Teach the VIMS Competencies on Engine Repair?

A. An advance organizer contains information presented prior to learning. It helps the learner organize and interpret new information. This is important when learning the interactions of an engine. "Understanding how engines operate and what causes wear and damage, allows an individual to recognize troubles and be in a position to deal with them" (Barbarossa & Bono, 1988, p. 48). ASE task A001 will be used to illustrate an advance organizer. A001 states, "Verify complaint and/or road test vehicle: determine repairs." Following are some suggestions:

1. Develop with the students a list of questions to be asked on a tour. Take a tour of an existing garage to let students observe a mechanic who is determining engine repairs. Provide an opportunity to question the mechanic. Upon returning to class, write a summary of the observation and a list of key points. Review questions cooperatively in groups of 3 or 4 students.

2. Give handouts of vocabulary words and discuss each term as students write down the definitions. Use an overhead projector to list the definitions for the students who have difficulty following auditorily.

Trouble Shooting Brakes



Scraping Noise From Brakes
- Worn out brake lining
- Uneven brake lining wear
- Bent broken, distorted brake shoes
- Loose or missing brake assembly attaching parts
- Incorrect wheel bearing adjustment
- Loose front suspension parts
- Interference between caliper and wheel or rotor
- Scored or tapered brake drum

Brakes Squeak
- Worn out brake lining
- Glazed or poor quality brake lining
- Contaminated brake lining
- Excessive brake lining dust
- Weak, damaged or scored brake drum or rotor
- Burred or rusted caliper
- Rough or dry drum brake backing plate ledges

Brakes Chatter
- Loose or missing brake assembly attaching parts
- Bent or distorted brake shoes
- Glazed brake lining
- Loose caliper attaching bolts
- Loose front suspension parts
- Heat-spotted or scored brake drum or rotor
- Out-of-parallel rotor
- Loose wheel bearings

Brakes Drag
- Contaminated brake fluid
- Maladjusted parking brake cables
- Faulty automatic adjusters
- Sticking wheel cylinders or caliper pistons
- Brake pedal binding at pivot
- Maladjusted master cylinder push rod
- Malfunctioning master cylinder
- Faulty metering valve
- Faulty proportions valve
- Restricted lines or hoses

Pedal Pulsates
- Out-of-round drums
- Excessive lateral runout of rotor

Brakes Pull To One Side
- Unequal air pressure in front tires
- Unmatched tires on same axle
- Grease or fluid on brake lining
- Loose caliper attaching bolts
- Seized wheel cylinder or caliper
- Restricted brake lines or hoses
- Worn or damaged wheel bearings
- Loose front suspension parts
- Faulty combination valve

Brakes Grab
- Grease or fluid on linings
- Maladjusted parking brake cables
- Heat-spotted or scored brake drums or rotors
- Maladjusted master cylinder push rod
- Loose caliper attached bolts
- Binding brake pedal mechanism
- Malfunctioning power brake unit

Slow Pedal Return
- Clogged holes in quick take-up valve

Brakes Fade
- Defective master cylinder
- External fluid leak
- Vapor lock in system
- Thin brake drums
- Crystallized brake lining

Pedal Spongy
- Air in hydraulic system
- Bent or distorted drum brake shoes

Excessive Pedal Effort
- Glazed or poor quality brake lining
- Sticking wheel cylinder or caliper pistons
- Calipers binding on mounting pins
- Binding or damaged pedal linkage
- Partial brake system failure
- Excessively worn brake linings
- Clogged quick take-up valve
- Insufficient vacuum to power brake unit
- Restricted or clogged lines or hoses
- Contaminated brake fluid
- Malfunctioning master cylinder
- Faulty proportioning valve
- Leaking or loose power brake unit vacuum hose
- Defective power brake unit

Brake Warning Light On
- Insufficient fluid in master cylinder reservoirs
- Hydraulic system failure
- Parking brake ON or not fully released
- Insufficient vacuum to power brake unit

Excessive Pedal Travel
- Air in brake lines
- Fluid leak
- Faulty automatic adjusters
- Maladjusted master cylinder push rod
- Worn drum lining
- Fluid bypassing quick take-up valve to reservoir
- Partial brake system failure

(Tobolski, Johnson & Olive, 1989, p. 667-668)

3. An acronym depicting the steps involved can help a student organize the steps needed. Other automotive vocabulary words could be adapted to other competencies.

C - Competency covered (Determining needed repairs)
A - Ask the customer questions (What is the car doing?)
R - Road test the car if possible (What is indicating a problem?)
S - Systems check (Hook up to analyzer, if necessary)

Q. How can the Student use Self-Monitoring for This Competency?

A. One possible method to encourage self-monitoring is setting up three to four work stations in the lab. At each station the teacher would provide a scenario of a typical engine repair and series of questions to determine needed engine repairs. Students could work cooperatively in small groups. At each station, an answer key should be available so the student can receive immediate feedback.

Next, the student would fill out a personal progress chart. It could include the following information:

Competency #_____ Student Name_____

Steps followed	(+) correct/ (-) incorrect
1.	
2.	
3.	
4.	
5.	

Good Work Behaviors

(Self-grade on assignment (1 = needs improvement; 2 = satisfactory; 3 = excellant)

1. Worked well within group	
2. Followed directions	
3. Performed to the best of my ability	
4. Completed all the questions	

During a group discussion, the teacher could help the students further by asking questions like: "What did you do best on the assignment? What part was the most difficult? How could you perform better next time?" The last question could lead into setting goals for the next competency or increased accuracy on this competency.

Each student would save their progress charts for an entire week. The points, recorded on a tally sheet, would accumulate each day. At the end of the week, students could compare totals against previous weeks to note the progress they have made. The instructor could also implement peer grading at the end of the week. This allows each student an opportunity to see how others view their performance. A menu could be developed with the students help, in which items could be purchased with the points they earn each week. By varying the worth of the menu items, some items could be purchased immediately while others would require the students to save points.

Self-monitoring helps the student target areas that need improvement and is motivating through the use of positive feedback. Depending on the population a teacher works with, many variations to self-monitoring are possible. Self-monitoring needs to be taught to better prepare students to perform independently.

Q. Where can I get More Information About Materials Available in the Area of Automobile Mechanics?

A. A number of auto mechanics materials are currently available from a variety of sources. Some of those sources include:

The Media Center
State Fair Community College
3201 West 16th Street
Sedalia, MO 65301
(816) 826-7100

Instructional Materials
Laboratory (IML)
University of Missouri-Columbia
2316 Industrial Drive
Columbia, MO 65202
(314) 882-2883 or
(800) 669-2465

Oklahoma State Department of
Vocational and Technical Education
Stillwater, OK 74074

Minor Automotive Maintenance
Occupational Curriculum Laboratory
East Texas State University
Commerce, TX 75428
(214) 886-5623

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